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Please replace page 23 with the following replacement page 23:

SCM with the "D" symbols achieving channel capacity can be derived from the above equations. The result is:

$$C=(b-1)\cdot B\cdot \log_2\left(1+\frac{SNRc}{b}\right) \quad \text{(Eq. 3)}$$

These bits are used for qualifying the analog symbols in the analog portion. As there are 2B symbols/sec and C bits/sec, there are M = C/2B bits per analog symbol. Now, the analog signal in the range [-a,a] is not transmitted in full. Instead, it is amplified by a factor $2^M$.

The signal to noise increase is the square of the magnification, thus it equals $2^{2M} = 2^{C/B}$. Therefore:

$$SNRd=\frac{SNRc}{b}\cdot 2^{\frac{C}{B}} \quad \text{(Eq. 4)}$$

Substituting Eq. 3 for C in Eq. 4:

$$SNRd=\frac{SNRc}{b}\cdot 2^{(b-1)\cdot B\cdot \log_2\left(1+\frac{SNRc}{b}\right)} \quad \text{(Eq. 5)}$$

And simplifying:

$$\boxed{SNRd=\frac{SNRc}{b}\cdot\left(1+\frac{SNRc}{b}\right)^{b-1}} \quad \text{(Eq. 6)}$$

This result is graphically shown in Figure 11 compared with the Shannon bound for values of b=2 and 4. Since, in the cable modem applications, the "analog" signal is carrying 64QAM or 256QAM signals, the useful output SNR for SCM is above 30dB. At this high output

level, it is evident from the graphs that SCM is close to the Shannon bound within fractions of 1dB. Thus SCM is essentially an ideal modulation scheme. The practical implementation of SCM will introduce some deficiencies to this ideal model. The most obvious one is that the "D" symbols undergo coding of practical complexity, thus the "D" symbols do not meet the channel capacity. Another limitation is scale related. The use of QAM for the "D "symbols is optimal only in one point of channel SNR, thus SCM will follow the curve "Practical SCM" in Figure 11, which is close to the Shannon bound only in one point. This practical SCM is still advantageous over the PCM "source coding", all-digital alternative shown in a dotted line in Figure 11. While at the threshold corner point 1101, both techniques are equal, as channel SNR increases, the SCM SNR improves, thus giving higher error margins for the carried payload.

In the preferred embodiment shown in Figure 10, quadrature amplitude modulation (QAM) may be used. This scheme is conveniently implemented as a two-dimensional SCM, a special case of the operations discussed in conjunction with Figure 9. The input analog signals are sampled at the output of a synchronous quadrature receiver similar to the cable modem points 319 and 326 in Figure 3. The processing of these signals is illustrated in Figure 12. The input